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RFID Becomes Fashionable in the Supply Chain: The Case of Kaufhof and Gerry Weber

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ABSTRACT

The paper reports on the results of a five-month project utilizing Radio Frequency Identification (RFID) along a fashion retailing supply chain. The supply chain included the fashion manufacturer Gerry Weber and department store retailer Kaufhof. The project identified numerous issues that should be addressed in a successful implementation of RFID including the technical choices and design of the readers and transponders; the likely process changes; the varying costs of the transponders and systems; potential concerns regarding consumer privacy; and the implications for cost reduction, revenue enhancement and overall organizational performance. Project outcomes suggest a positive business case for adopting RFID for all members of the supply chain. Implications for practice are discussed.

Keywords

RFID, Supply Chain Management, Case Study

INTRODUCTION

The trade press is full of writers and advocates touting the value of Radio Frequency Identification (RFID) to the supply chain. SAP suggests that RFID "enables you to tie together the physical flow of materials and the flow of information in the supply chain network and to operate with unprecedented levels of accurate, timely information" (SAP, 2005). Other vendor websites are replete with claims. "Companies can more accurately track assets and monitor key indicators, gain greater visibility into their operations, and make decisions based on real-time information" (Oracle, 2005). I2 suggests that through "receipt and issuing of goods, stock transfer, physical adjustments, and other transactions, as well as exception and resolution workflows, RFID is ideally suited to helping retailers." (I2, 2005). No doubt, there is a growing body of opinion that casts RFID as the "missing link" in supply chain management (Heinrich, 2005).

How does RFID impact the partners in a supply chain? To realize the potential of RFID, companies must take into account several crucial aspects of RFID (e.g., Loebbecke, 2006). What emerges from the following case study are five key categories, the five Ps, that need to be evaluated in a firm's consideration of RFID (see Figure 1): the *Physics* of the transponder, the reader, and the data transfer; the *Processes* being changed and enhanced, the *Prices* for technical components and their installation, the *Privacy* aspects of capturing and retaining customer data, and the *Performance* impacts, the business case contribution, of RFID implementations.

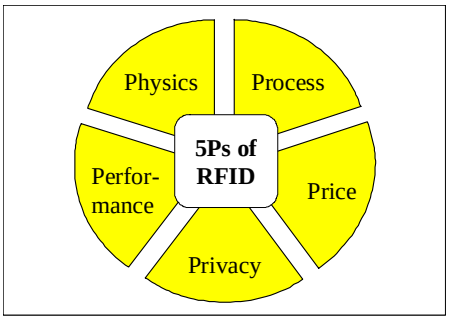

Figure 1. Five Ps of RFID

CASE SETTING

The Fashion Industry

The fashion industry provides a well qualified setting for studying the potential for RFID, both on logistics units and on individual items. It involves consumer products of varying price, packaging, and shelf life (fashions!) that are supported by a multi-tier supply chain, which typically involves manufacturers, distributors, and retailers.

For years, the global fashion industry has been undergoing a process of pervasive change fueled by two major macroeconomic drivers: Evolving economic and political conditions have called for flexibility and innovation, and leaner economic times have reduced consumer buying power. As a result, increasingly discount retailers (e.g., WalMart, Aldi) and verticals, i.e., international fashion chains with their own production facilities (e.g., the GAP, Zara) have entered and won a remarkable share in the market.

Also, today's customers have an impact and often set the tone. They expect individualized product offerings and personalized service, along with regularly updated collections, often as frequently as every 14 days.

As a consequence of changing market conditions and demanding customers, the entire fashion industry faces unprecedented challenges. To meet these challenges, fashion manufacturers (e.g., Benetton) and retailers (e.g., WalMart) have increasingly turned to cutting-edge technology.

Two prime examples of technology pioneers are Kaufhof Department Stores (Kaufhof) and fashion manufacturer Gerry Weber International AG (Gerry Weber). United by courage and a pioneering spirit, they have joined forces in exploiting the benefits of RFID technology along the fashion supply chain.

Kaufhof Department Store AG and Gerry Weber

Kaufhof Department Store AG, a sales division of the METRO Group, is one of the leading department stores in Europe. The company celebrated its 125th anniversary in 2004. As of October 2005, Kaufhof operated 134 stores (116 of them department stores) in more than 80 German cities, and 15 stores in 12 Belgian cities. Every day, more than two million customers visit Kaufhof's total of 1.5 million square meters of sales area in Germany and Belgium. The company employs a workforce of about 27,000 and - in 2004 - generated €3.8 billion in sales, about 35 percent of those with fashion sales. Kaufhof's EBIT reached €56.1 million or 1.47 percent, which gives evidence to the scarce margins of department stores and underlines the cost pressures in fashion retailing.

Gerry Weber International AG is a German fashion and lifestyle company with worldwide operations founded in 1973. The Gerry Weber holding company comprises three brands: Gerry Weber, Taifun Collection, and Samoon Collection. The company counts around 800 shops with their shop-in-shop system. In the business year ending October 2005, Gerry Weber International AG earned about €400 million in sales, with a workforce of almost 1,700. With an EBIT margin of more than 8 percent, the results are above the industry average. The company's most important retail markets are Germany, England and Ireland, the Benelux countries, Austria and Switzerland. In addition, Scandinavia, Eastern Europe, the Middle East and Far East, as well as Canada, are gaining in importance.

In their combined supply chain, each new Gerry Weber collection has traveled a long way by the time it is introduced in Kaufhof department stores. From the Gerry Weber production facilities the merchandise is delivered to the logistics service provider (Meyer & Meyer) and on to the Kaufhof distribution center, from where it is brought to the storage and display areas within each department store.

Case Analysis

The case analysis methodology was used in analyzing the RFID project (Yin, 1989). This involved the collection of data through interviews, observation of and participation in the implementation, and review of internal source materials including memoranda and financial projections. The time frame allowed the research to investigate both the implementation and actual use of the RFID technology.

THE KAUFHOF - GERRY WEBER RFID PROJECT

The main objective of the RFID project undertaken by Kaufhof and Gerry Weber was to assess the business performance, includung the degree to which RFID can accelerate and simplify workflows throughout the fashion supply chain in a real-world environment (e.g., METRO AG, 2005). A further goal was to analyze the use of RFID technology in anti-theft systems, a topic that has traditionally been of particular interest in fashion retailing (e.g., Bamfield, 2004)

The project was launched on July 1, 2003 and ran through November 30, 2003. Gerry Weber's entire assortment sold at Kaufhof was considered in the project.

Kaufhof and Gerry Weber then split the costs of the RFID transponders, which were put on each product and each logistic unit. The frequency range used was 13.56 MHz for item level and unit level tags.

Several project specific hardware pieces were installed: Gerry Weber and Meyer & Meyer, the Logistics Service Provider, each installed two RFID readers, both in the outgoing goods areas, one for stackable goods and one for hanger-goods. Further, at Gerry Weber headquarters, an RFID printer for generating tags was implemented. The Kaufhof Distribution Center was equipped with four RFID readers, both in the incoming and in the outgoing goods area one for stackable goods and one for hanger goods. In addition, a printer was set up to produce transponders for logistic units (Serial Shipping Container Code - SSCCs[1]). Hanger-good conveyor systems were equipped with RFID technology. One Kaufhof Department Store was then provided with two escalator exits with anti-theft gates, two cash registers connected to the check-out system, one mobile reader, one RFID printer, and one Intelligent Clothes Rack. The second Kaufhof Department Store only required one shelf antenna, one cash register, one mobile reader, and one RFID printer.

At the time of the project, the Electronic Product Code (EPC[2]) had not received final approval as a standard. So, Kaufhof and Gerry Weber utilized the European article number (EAN) as the key identification number. In addition, they took advantage of an internal Gerry Weber identification code. The different codes stored on the transponders distinguished between logistic units and items. An anti-theft code, which was also incorporated in the transponder, could be read at the two Kaufhof anti-theft gates installed on two escalators in one test store. (Department store exit gates are too large to be fully covered by 13.56 MHz reading range of 1.5 meters.)

THE 5 PS OF RFID IN THE KAUFHOF AND GERRY WEBER PROJECT

Physics

Kaufhof and Gerry Weber used the frequency range of 13.56 MHz for both logistic units and items. In 2003 it was the only frequency available for both. The alternative, using two different frequency ranges for logistic units and items, would have called for two different sets of readers and transponders and thus increased the project costs substantially.[3] Credit card sized transponders and readers with a permissible capacity of 0.5 watts were used at a reading range of approximately 1.5 meters.

The nature of materials marked the first physical restraint, as it influenced the reading quality. During the project, individual transponders were placed in or on different materials, both water (included in the tests although less relevant for the fashion industry) and metal: Water did not influence the reading procedure at the frequency of 13.56 MHz. Regarding metal, an aluminum package (4 cm thick) was used, as well as a matchbox-sized package of paper clips (0.5 cm thick) and a coin. Metal had some negative effect on the reading ranges, as it absorbed the radio waves. The coin did not disturb the reading process, indicating that metal buttons and zippers on fashion items would not pose a problem. However, any metal surface with the size of a matchbox required a distance of 0.5 cm for the transponder to be read. For example, the reader could not register a transponder directly affixed to a metal belt buckle. The reading quality deteriorated further with larger metal surfaces.

In addition, distance between the transponders also turned out to be important for the reading rate. Initial readings for hanger goods were unsatisfactory. Problems arose with transponders attached to garments made of thin material, hung close together. The effect was worsened when the products were fitted with slip covers and grouped into logistic units. Reading was disrupted when the angle between the transponder and antenna was close to 90 degrees. In most cases, a minimum distance of 0.5 centimeters was required between two transponders. However, should a shipment pass through the reading portal with each transponder at exactly the same height, a minimum distance of between 1.5 and 3 centimeters was required to avoid interference. Having investigated the problems and made some adjustments to the set ups of the distribution center, the warehouses and the stores, the reading rate was at over 99 percent after the first four weeks of the project.

1 Serial Shipping Container Code (SSCC): Internationally valid number for logistic units allowing the exact identification of transport units.

2 The Electronic Product Code (EPC) consists of the European article number (EAN) and a nine-digit serial number. Since 2004, the EPC has been established as a quasi-standard in consumer goods industries.

3 Since the METRO Group roll-out of RFID technology in November 2004, Kaufhof along with other participating sales divisions and cross divisional service companies has also used the frequency range of 868 MHz for RFID transponders on logistic units allowing for reading from a distance of up to eight meters.

Another concern of tag proximity was the reading capacity when many tags passed the gate simultaneously. Registering data simultaneously and automatically is crucial for streamlining logistic processes. So, bulk readings, i.e., multiple and simultaneous transponder readings, were conducted.

From the beginning most bulk readings worked without difficulty in the project, even the use of metal hangers posed no problem. Only when wider parts of the metal hangers, such as brackets on pants hangers, were in direct contact with transponders was the reader unable to register the data. These cases required set up adjustments to avoid such direct contacts.

Finally, the speed at which the hanger-good shipments were transported through the gate turned out to be an issue: the more transponders, the lower the speed. RFID readers simultaneously registered around 180 transponders on hanger goods with the transponders remaining within the portal for approximately 20 seconds. With stackable goods in cartons, up to 60 transponders were registered within about three seconds.

Processes

The RFID project involved the entire process from tagging, packing, and shipping logistic units and items through distribution and warehousing on to display, sales and theft prevention at the stores.

Tagging and Packaging. Gerry Weber generated the RFID transponders for items at their headquarters in Westfalen, Germany. The tags and merchandise were then sent to the logistics service provider. Staff at the logistics service provider carried out order-picking of the goods destined for the two Kaufhof test stores participating in the project and outfitted each item with a transponder.[4] The hanger-goods, such as dresses, pants and jackets were then packed in slip covers, while the stackable goods (e.g., sweaters and t-shirts) were packed in cartons. RFID readers installed in the outgoing goods area at the logistics service provider scanned the packed merchandise before it was loaded on trucks for transport to a Kaufhof distribution center. Merchandise picked for an order was automatically matched with the shipment demanded and approved for transport, while the merchandise planning and control system registered the outgoing goods.

Tracking in Warehouses. Gerry Weber delivered orders to Kaufhof based on the increasingly popular *Cross-Docking* concept. With Cross-Docking, the employees in the distribution center are not required to repackage and sort goods for shipment to individual stores. Instead, the products are delivered in cartons or as hanger-goods as ordered by the stores, and transported without storage at the logistics service provider. The distribution center staff only equipped the Gerry Weber goods with Serial Shipping Container Code (SSCC) tags, and brought them to the outgoing goods area.

At the warehouse entrance of Kaufhof's distribution center, Kaufhof employees utilized RFID readers to track the Gerry Weber merchandise as it came in. They registered the delivered products, distinguishing stackable and hanger goods. The EANs (by early 2006: EPCs) stored on the RFID transponders were read automatically for each individual product. For hanger-goods, the task of counting hangers was eliminated. This allowed quantity control of 100 percent of merchandise to take place automatically at the warehouses compared to previous spot checking of only 10%.

Tracking and Locating in Stores. Kaufhof personnel utilized RFID technology for inventory and delivery tracking of the smaller logistic units. Hanger- and stackable-good shipments with RFID transponders arrived from the distribution center and passed through the incoming goods portals of the stores. Kaufhof staff scanned the RFID transponders on the Serial Shipping Container Code (SSCC) tags with a mobile RFID reader. The data were automatically entered into a central database and then compared to the values in the Kaufhof merchandise management system[5].

In the stores, Kaufhof employees used mobile RFID readers to register RFID transponders. They simply walked by the merchandise to gather the data; they no longer needed to scan each individual barcode. Thus they could locate individual items and take inventory at the push of a button.

Improving Sales Related Processes through Shelf Management. Item level RFID also enhanced sales process options (see also Loebbecke, 2004): Intelligent Clothes Racks and Smart Shelves allowed Kaufhof to gain additional intelligence about the customers' shopping and buying behaviors, which could then be used for further improving product and service offerings: *Intelligent Clothes Racks* are equipped with an RFID antenna. Each time a customer or employee removes a fashion item equipped with an RFID transponder from the rack, the movement is automatically entered into the merchandise management system. The moment the article is returned is also registered. The time that lapses before a customer returns an item to the rack provides valuable information: If a customer puts a blouse back on the clothes rack after five seconds, she possibly does

4 A manufacturer has the choice of affixing RFID transponders and conducting order picking in-house or outsourcing the tasks to a logistics service provider.

5 The Merchandise Management System (MMS) is a computer-aided Information System that registers and manages goods based on amount and value.

not like the material. If five minutes go by, it is likely that the customer tried on the article. *Smart Shelves* offer similar functionalities for stacked goods.

Check-Out Processes. Selected cash registers were equipped with RFID readers and connected to the Kaufhof merchandise management system. In order to complete the checkout and payment process, staff merely placed the fashion goods onto the cash desk. All RFID transponders were simultaneously read and subsequently removed from the goods. With the total amount to be paid displayed at the cash register, customers then continued the check out with traditional payment procedures (credit card, cash, etc.).

Theft Prevention. The RFID readers in the test anti-theft gates registered the data on the RFID transponders. If the status 'not sold' was indicated, an alarm was triggered. However, data collection on theft prevention was rather limited due to two reasons: Different from normal settings: (1) Only 'escalator gates', not the much wider department store gates, could be covered by the limited width reading range, and (2) the alarm would also be triggered if customers carry items across department store levels, consequently passing escalator gates, without paying, i.e., without deactivating or eliminating the transponder.

Price

In 2003, the key price points to consider when implementing such a system were those related to the RFID transponders. With the number of logistic units and individual items to be tagged, achieving a lower price per transponder was the definitive variable required to make a successful RFID business case. Kaufhof and Gerry Weber examined two transponder pricing scenarios in detail, one with the use of reusable and one with disposable transponders:

- *Reusable transponders* allow information to be rewritten and reused. At a 2003 unit price of €1 for reusable transponders, including common radio frequency and audio-magnetic theft protection systems, Kaufhof and Gerry Weber predicted a positive ROI after 1.5 years. The necessary processes of removing the transponders and recycling them for further use were the largest contribution to price.
- *Disposable transponders* allow only for single use. At a unit price of €0.30 and €0.50 including theft protection in 2003, disposable transponders were not considered as part of a successful business case. Kaufhof and Gerry Weber predicted that the profitable usage of disposable transponders required a major drop in the price per transponder and the required set up processes. [Then and now actual prices and price projections varied widely based on transponder capabilities and on assumed RFID adoption].

The price for the entire RFID project also included a key price point on hardware for RFID antennas and readers. The readers needed to be placed at warehouses, incoming goods portals at stores, at checkout points, and for theft prevention at exit points. Software needed to be developed and implemented that allowed for full integration of RFID related hardware with the existing merchandise management systems and other back-office systems. Training was also taken into account as adding to the price of the system.

At the beginning of the project, both partners jointly opted for reusable transponders as the only viable business case in spite of necessary deactivation and redemption of transponders and subsequent recycling. However, with prices for disposable transponders dropping sharply right after the project, the insights from the project made Kaufhof and Gerry Weber shift to disposable transponders in their preparation of the subsequent roll-out.

Privacy

Privacy was not a major focus of the RFID project as the project design planned for the transponders to be deactivated and eliminated at the cash register. But it played a role. Privacy issues in the narrow sense, relevant in the context of item level tagging, concerned situations in which transponders were purposefully or mistakenly not deactivated or eliminated after check out and then carried the risk of linking customer information to product details including product location after purchase.

The fear was that unless RFID transponders were fully and securely deactivated after check-out as a matter of routine, third parties including other retailers who were close enough could read them even without the knowledge of the original purchaser (see also Kleist, Chapman, Sakai, and Jarvis, 2004).

Another issue, even if less discussed in public, was the worry that the back-end database systems intended for EPC management could impose a major privacy threat. The EPC concept implies a single organizational unit having access to enormous amounts of collected personal data - certainly much more than stored and perhaps readable from the transponders.

Kaufhof and Gerry Weber addressed the privacy issue by training employees and by providing information to customers at the point of purchase: If all transponders were cut off before customers leave the store, the additional service potential meant to be beneficial for customers could not be offered. Examples of such potential customer goodies include price reductions, insurance coverage in the context of traveling, or advice on how to properly wash the garments in the smart laundry machine. However, at the pilot stage of the project, the transponders were routinely cut off as no follow up service options were readily applicable at the point in time and the information was conveyed to customers accordingly.

Performance

At both Kaufhof and Gerry Weber, three indicators of positive performance impacts were observed: the shortening of the time span of merchandise moving through the supply chain, the reduction in affiliated labor required, and finally the enhanced data quality and subsequent service offerings made possible. Both Gerry Weber and Kaufhof individually projected benefits that substantially exceeded costs and the entire supply chain benefits also exceeded costs.

In the Warehouse. A variety of efficiencies were evident in the warehouse processes.

- Faster quantity control and packaging: Traditionally, Gerry Weber performed a 100 percent quantity control on all shipments before they left the warehouse by manually scanning each barcode. With RFID, this quantity control and packaging took place up to ten times faster. These improvements were evident in the incoming, internal, and outgoing stages of the packaging and labeling.
- Automatic and complete inventory monitoring: Counts of hanger-goods could be performed automatically. Stackable goods in cartons such as shirts and pants, which were not hand-counted without RFID, were automatically counted one by one with RFID readers installed on a conveyor belt. Altogether Gerry Weber could track the availability of merchandise in stores and in transit with reading costs per palette of below €0.30.

In the Store. In-store performance indicators were positive in four critical areas:

- Less out of stock: By reducing out of stock positions for stores and insuring that products were available for purchase, Kaufhof experienced increased sales.
- Overall lower warehousing and handling costs: Goods moved more rapidly once within the store to display points and goods that have been moved by employees are customers within the store were more rapidly identified and returned to the proper display point.
- Faster inventory taking: RFID allowed inventory counts up to four times faster than by conventional means. Faster inventory also meant faster replenishment of goods for customers.
- Faster payment procedures: RFID supported accelerated payment procedures at the check-out.

LESSONS LEARNED

Each of the 5 Ps in the Kaufhof and Gerry Weber RFID project led to three main lessons, which since have been transferred to further applications and larger roll-out.

Physics

- RFID technology already functions at a high level of reliability and accuracy. Hardware and software are being developed and extended very quickly, as is evident even since the completion of the project.
- Reading the code created some difficulties depending on the product itself and the delivery platform employed.

  For example, metals within, on, or around products create some reading challenges. Also tightly packed items make it difficult to accurately read individual tags. For now, those reading difficulties are likely to continue. However, future technological advances may offer solutions which react less sensitively to metal or liquids and allow readers to bridge larger reading distances.
- No single frequency fully suits the needs for both the distribution center (logistics) applications and item level in-store usages of RFID.

Processes

- RFID simplifies, accelerates, and improves existing processes (e.g., taking inventory 'at the push of a button') and also allows for new value-creating ones.
- RFID driven process improvements require accompanying changes in store formats and arrangements as well as in equipment.
- New processes allow gathering enhanced intelligence about customer's shopping and buying behavior by tracking the flow of goods at Intelligent Clothes Racks and Smart Shelves

Price

- The price of RFID transponders is critical and must decrease to make large scale adoption economically viable. With major price drops - the single use transponder prices dropped from €1 in July 2003 to €0.07 for 868 MHz tags and to €0.12 including tag material and data printing for 13.56 MHz tags in October 2005 - large-scale implementations are likely to deliver positive business cases.
- In the near future, item level tagging only seems justifiable for high-end products and luxury articles where RFID represents only a small percentage of the total end consumer price.
- Item level tagging also becomes increasingly requested for products that need to be tracked due to governmental regulation such as product recalls (e.g., EU Regulation 178/2002). Should a recall program be necessary, RFID enables retailers and manufacturers to conduct it in a targeted, safe, and efficient manner. Early fashion examples could include fur products or synthetics with special composite materials.

Privacy

- Consumer concerns regarding their privacy and the use of RFID exist and are aired.
- Even routinely deactivating RFID transponders after check out requires intensive communication with customers to encourage them to trust the deactivation and the technology per se.
- Additional services perceived by customers as true value added (price reductions, warranties, health implications of certain garment materials) may outweigh privacy concerns.

Performance

- With RFID, retail companies can realize cost-savings due to better management and monitoring of their inventories, increase efficiency and offer better services to their customers and supply chain partners.
- In the warehouses, especially the increased data accuracy, reduced time for inventory tracking, and faster palette and case cross-docking speed up the processes and make warehousing more efficient.
- In the stores, in addition to inventory tracking and better customer offerings, fewer stock outs are possible even with reduced stock levels.

SUMMARY AND OUTLOOK

The case of Kaufhof and Gerry Weber suggests that the 5Ps are important for any firm evaluating or implementing RFID. To take full advantage of the RFID technology potential, firms must examine if

- RFID *physics* are appropriate for the context,
- Equipment *price* and implementation *prices* can support a positive business case,
- Work *processes* can be adapted to the new capabilities,
- Employee and user *privacy* concerns are manageable, and
- Inventory management, data accuracy, tracking, and security are areas in which improvements and enhancements of *performance* are sought.

Overall, the Kaufhof and Gerry Weber project shows positive and very promising tests of RFID viability under real-life conditions. While there continue to be technical, data management, and privacy issues for RFID, positive performance

impacts of data collection and information management at both the warehouse and store level offer a strong business case for both retailers and suppliers.

The Kaufhof-Gerry Weber example encourages companies in different fashion supply chains. It suggests that partner companies in any major fashion supply chain benefit from RFID. Starting early on the learning curve has proven beneficial. After the first experiences, RFID along the supply chain leads to optimized warehouse and inventory management, increased overall process efficiency, and significantly improved workflows within the store. Consumers may be offered specialized services.

Also, the fashion industry exhibits several key similarities with other retail industries, including the multi-tier supply chain, the need for quick response for fulfillment, and the degree of perishability of items. Experiences at related retailers and suppliers, such as Kaufhof's parent company METRO AG, suggest that improvements in warehouse, inventory, and store level performance can be replicated in other consumer goods sectors. 2005 figures from METRO AG indicate warehouse processes dealing with pallets and cases have experienced time savings of 22% for goods receipt and 80% for product verification and similar results for in-store goods receipt (25%) and verification (75%) in their grocery business (e.g., METRO AG, 2005).

The RFID trial and demonstration carried out by two RFID pioneers in a real-world environment, across the supply chains, has recognized both current and likely future boosts in efficiency and makes a strong business case for RFID.

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